

B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Third Semester

ELECTRONICS AND INSTRUMENTATION ENGINEERING

U18MET3007: Mechanics and Thermodynamics

COURSE OUTCOMES

- CO1: Explain the concepts of thermodynamics and mechanisms of heat transfer.
CO2: Discuss the working of turbines and boilers.
CO3: Apply the fundamental concepts in determining the effect of forces on a particle.
CO4: Apply the concept of Euler and Bernoulli's equation for solving fluid flow problems.
CO5: Analyze the performance of various fluid machines.

Time: Three Hours

Maximum Marks: 100

**Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)**

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|---|-----|-------------------|
| 1. Explain the difference between a closed system and an open system. | CO1 | [K ₂] |
| 2. What is the steady flow energy equation (SFEE)? | CO1 | [K ₂] |
| 3. Describe the impulse principle of steam turbines. | CO2 | [K ₂] |
| 4. What types of boilers are commonly used in steam generation? | CO2 | [K ₂] |
| 5. Define the center of gravity and center of mass. | CO3 | [K ₁] |
| 6. What is the significance of the radius of gyration? | CO3 | [K ₂] |
| 7. Explain Bernoulli's equation in the context of fluid flow. | CO4 | [K ₂] |
| 8. Describe the function of a Venturi meter. | CO4 | [K ₂] |
| 9. What are the performance curves of a centrifugal pump? | CO5 | [K ₂] |
| 10. Discuss the working principle of a Pelton turbine. | CO5 | [K ₂] |

**Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)**

11. Scenario: A manufacturing plant needs to design a new cooling system for its electronic components. The components generate 500 W of heat, and the cooling system needs to keep the temperature rise below 15°C above the

ambient temperature. The plant is considering using thermoelectric cooling or chip cooling solutions.

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|---|---|---|-----|-------------------|
| a) | Explain the working principles of thermoelectric cooling and chip cooling. | 7 | CO1 | [K ₃] |
| b) | Compare the advantages and disadvantages of these cooling methods for the given scenario. | 7 | CO1 | [K ₃] |
| c) | How does temperature affect the viscosity of liquids? | 2 | CO4 | [K ₂] |
| 12. Scenario: A power plant is upgrading its steam turbines. The plant currently operates with a Rankine cycle, and they are considering switching to a more efficient cycle. The plant engineers are evaluating the impact of using impulse and reaction steam turbines. | | | | |
| a) | Discuss the differences between impulse and reaction turbines. | 7 | CO2 | [K ₂] |
| b) | Explain how each type of turbine affects the efficiency and operation of the steam power cycle. | 7 | CO2 | [K ₃] |
| c) | What is the purpose of a nozzle in a steam turbine? | 2 | CO2 | [K ₂] |
| 13. a) Discuss the various types of boilers used in steam generation and their specific applications in textile industries. | | | | |
| b) | Explain the working principle of a Pitot tube and how it is used to measure fluid velocity. Include a detailed description of the equations involved and the physical principles that govern its operation. | 7 | CO4 | [K ₃] |
| c) | What is convection heat transfer? | 2 | CO1 | [K ₂] |
| 14. a) Explain the practical applications of Venturi meters in oil and gas industry. and describe how the Venturi meter is used in measuring the fluid flow. | | | | |
| b) | Analyze the role of Francis turbines in hydropower plants, particularly in terms of energy efficiency and environmental impact. | 7 | CO5 | [K ₃] |
| c) | What do you mean by head of a hydraulic turbines. | 2 | CO5 | [K ₂] |
| 15. a) Explain the working principle of a centrifugal pump and how it converts mechanical energy into hydraulic energy. Discuss the main components involved and the significance of each in the operation of the pump. | | | | |
| b) | A 10 kg block is placed on an inclined plane at an angle of 30° to the horizontal. The coefficient of static friction between the block and the plane is 0.4. Draw the free body diagram of the block | 7 | CO3 | [K ₃] |

- c) State D'Alembert's principle and explain its significance in dynamics. 2 CO3 [K₂]
16. a) A rectangular plate has a width b and height h . Calculate the radius of gyration about an axis through its centroid and perpendicular to the plane of the plate. 7 CO3 [K₃]
- b) Discuss the advantages and disadvantages of using Pelton wheel turbines in high-head hydroelectric power plants. 7 CO5 [K₃]
- c) State the principle of impulse and momentum and explain its significance in mechanics. 2 CO3 [K₂]
